SSCI 583 (Sections 35785D and 35787D), Spatial Analysis and Modeling

Syllabus

Units: 4

Term Day Time: Summer 2024 – T/Th 9:00-10:50am

Location: AHF 145A and DEN@Dornsife

Instructor: Katherine Lester, PhD
Office: AHF B55A
Regular Office Hours: T/Th 12pm-1pm. Also available by appointment via email.
Contact Info: lesterk@usc.edu, 213-740-5612

Library Help: Andy Rutkowski
Office: LIPA B40-A
Office Hours: By appointment via email
Contact Info: arutkows@usc.edu, see contact page on D2L for Zoom Room

IT Help: Myron Medalla
Office: AHF B56B
Office: By appointment via email
Contact Info: spatial_support@usc.edu, 213-740-4415

Course Scope and Purpose

Spatial analysis is key to the successful application of Geographic Information Sciences (GIS) to today's difficult and critical environmental and social challenges. While digital mapping technologies such as Google Maps, Google Earth and Microsoft's Bing Maps are now in widespread general use, GIS only reaches its full potential when the power of spatial analysis is engaged. Consumer-oriented mapping tools are simple and intuitive for most people to use, but spatial analysis requires a much deeper awareness of the underlying assumptions and methods. In fact, the easy access to very advanced spatial analytical tools in today's GIS is deceptive as it is fairly simple to walk through wizards and push buttons to perform an analysis, but much more difficult to produce a valid, defensible analytical result. With this in mind, the goal of this course it to help you become an informed spatial analyst.

This course aims to provide students with the knowledge and skills necessary to investigate the spatial patterns which result from social and physical processes operating on or near the Earth's surface. Essential theoretical concepts of quantitative geography are examined, including measures of geographical distribution (including point and areal pattern analysis) and spatial autocorrelation, interpolation and network connectivity. The focus is on understanding the theories and context of spatial analysis so that you are equipped to find and apply the best analytical tool for your problem and to correctly and appropriately interpret and present your results. Since proficient spatial analysis requires imaginative application of a myriad of available tools, there are far more tools and techniques available than we can possibly cover in a single course. Therefore, practical assignments in this course are not intended to provide comprehensive training in any of the wide range of available tools, but rather to develop skills that will help you find, understand and use the multitude of tools and, importantly, the related learning resources when you need them in the future.

This is a required course for the Spatial Analytics Track of the Master of Science (MS) Geographic Information Science & Technology (GIST), the MS in Spatial Economics and Data Analysis (SEDA), and the GeoHealth track in the Keck School of Medicine's M.P.H program, and an elective in the MS Spatial Data Science (SPDS), and Graduate Certificates in GIS and Geospatial Leadership.

Learning Outcomes

On completion of this course, students should be able to:

- List and differentiate between several different approaches to spatial analysis.
- Apply appropriate spatial references (datum and projection) to spatial data before undertaking analysis.
- Outline the geographic concepts of distance, adjacency, interaction, and neighborhood and discuss how these are fundamental in performing spatial analysis.
- Explain how point patterns, including clustering, can be identified and understood as realizations of spatial processes.

- Outline the central role that spatial autocorrelation plays in spatial analysis and explain how it helps and hinders the use of current tools.
- Demonstrate how different concepts about nearness and neighborhoods result in a variety of interpolation methods that produce different results.
- Outline the various ways that overlay is implemented in GIS.
- List several emerging geographical analysis techniques using temporal and 3D analysis.
- Plan, design and implement a spatial analysis project demonstrating the ability to select, apply and critically interpret appropriate methods for the analysis of geographical information.

Students may vary in their competency levels on these abilities. You can expect to acquire these abilities only if you honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

Prerequisite(s): SSCI 581 or permission of the instructor
Co-Requisite(s): None

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodations you may contact the Title IX Coordinator directly (titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours)

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect of others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Course Structure

The course is taught in a hybrid modality (depending on your section) with class meetings split between presentations and discussions of the assigned readings and any questions and related topics that arise from the readings. Depending on your section registration and requirements, students attend class sessions in person or participate in the course remotely/ asynchronously (DEN@Dornsife). The main theoretical concepts are provided through a directed reading of the text *Geographic Information Analysis.* Additional readings will be assigned to expand on the text when needed. The course will unfold in a modular manner with weekly meetings alternating between lecture and discussion of the concepts and student-based workshop sessions to develop spatial analysis workflows.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposed other than individual or group study is prohibited. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which has been distributed to students or in any way has been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Technological and Communication Requirements

ArcGIS Pro is provided online via the SSI Server (via a virtual machine); hence, students do not need to install it on their own computer. Instead, every student must have the following technology requirements:

- A computer with a fast internet connection
- A functional webcam and a microphone
- An up–to-date-web browser to access the SSI server

If a student does not have access to any of these, please speak with the instructor at the start of the semester. And see the USC ITS Student Toolkit here: https://keepteaching.usc.edu/students/student-toolkit/

Desire2Learn (D2L) – This course will utilize the Desire2Learn (D2L) learning management system which allows students to access course content, upload assignments, and participate in discussion forms, among other learning experiences. The D2L platform provides flexibility in the learning experience where students can participate in the course residentially or remotely, synchronously (meeting together at the same time) or asynchronously (accessing videos and course content outside of class).

SSI Server and Tech Support – This course utilizes the SSI Server, which is a virtual desktop that allows access to different types of professional software. If students are unable to connect to the server or experience technical issues, they should send an email (via their USC account) to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) the instructor on the email. Assignment specific questions should be directed to the instructor.

Communications – All assignments disseminated and all materials to be handed in will be submitted via D2L. The instructor will also create and monitor discussion forums through which students can discuss issues and assignments as needed. Students should read all email sent from D2L or from course instructor as soon as possible. Also, students who do not regularly use their USC email accounts should double-check to be sure that mail sent from both the D2L accounts and the instructor's account (noted above) to your USC account is forwarded to an address used regularly and does not go into junk mail. The instructor will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case that an instructor is off-line for an extended period of time, an announcement will be posted to the class D2L site. Due to the synchronous and asynchronous nature of this course, it is each student's responsibility to stay informed and connected with others in our course. In addition to email, students are expected to login to D2L regularly to check for announcements.

Discussion forums – On the D2L site, I will post a series of discussion threads relevant to various sections of the course. Discussions provide a key means for student-to-student discussion and collaboration that can replicate the face-to-face contact you may have experienced in traditional classrooms. Here students can provide support to each other while working on your assignments, sharing hints and helpful tips (but not final work products unless otherwise directed), as you would in a classroom setting. Please post your questions about assignments there, as you would ask them publicly in the classroom. I monitor the discussion threads and offer comments when necessary, but more importantly, consider the discussion board a key way to connect with your classmates and share your discoveries.

Required Readings and Supplementary Materials

The required textbooks for this course are:

- O'Sullivan, David, and David J. Unwin. 2010. *Geographic Information Analysis*, 2nd Edition. New York: John Wiley & Sons. While you may purchase this book if you wish to own a bound copy, it is available online through the USC Libraries. Sign on to the USC Libraries and search for this title.

The practical Mitchell books are useful in association with the theoretical text as a means of bringing theory into a working context. Used copies of these books are widely available online, so there is no need to pay the full retail price.

Supplementary readings will be assigned from various sources including:

- de Smith, Michael J., Michael F. Goodchild and Paul A. Longley. 2013. *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools*, 3rd Edition. Winchelsea, UK: The Winchelsea Press. Available in both print and a (free!) web version at www.spatialanalysisonline.com.
- Fisher, Peter F. and Nicholas J. Tate. 2006. Causes and consequences of error in digital elevation models. *Progress in Physical Geography* 30: 467-489.
- Kemp, Karen K., ed. 2008. *Encyclopedia of Geographic Information Science.* Thousand Oaks, CA: Sage Publications. Available online from the USC Libraries.

As well, for several of the assignments in this course, you will conduct online library research to find articles that apply specific techniques in an application area of your choice.

Description and Assessment of Assignments

This course includes a diversity of assessments that allow students to gain knowledge and experience and to show their mastery of the material in a variety of ways. The different types of assessments are described below and their overalls point value are summarized in the following Grading Breakdown section.

Resume Assignment – 1 worth 3 points. We require all current students to post and maintain a public resume, short biography, and recent photo on our shared SSI Student Community Blackboard site. This assignment is due at the end of the term, and thus should reflect the knowledge and experience gained through the course. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience and professional aspirations.

Projects – 5 worth a total of 71 points. These assignments – completed in pairs – require students to complete the basic types of analyses asked of professional spatial analysts in real-world settings. Prompts will list helpful information, such as software tutorials, for becoming familiar with ways that concepts learned in the course are implemented in various software packages. Each project has two deliverables: a workflow diagram and a final report that describes the student's goals, methods, data, and results for the project. The workflow diagram is due one week prior to the final deliverable and is workshopped in an online forum and during a synchronous class session with classmates and the instructor.

Reading and Research Discussions – 5 worth a total of 26 points. These assignments call on students to identify relevant research case studies employing the methodologies and concepts we cover in class and to discuss them with the instructor and their classmates

during course meetings and in online discussion forums. For one of the five, students take a lead in the discussion, posing questions and presenting case studies, and they receive greater course credit.

Grading Breakdown

Assessment	Number	Points Each	Total Points
Resume Assignment	1	3	3
Reading and Research Discussions			
Discussion Posts	5	1	5
Discussion Leaders	1	13	13
Discussion Followers	4	2	8
Projects			
Workflow Reviews	5	3	15
Projects 1,2,3 Reports	3	12	36
Projects 4,5 Reports	2	10	20
Total	**21**	**-**	**100 points**

Grading Scale

Assignments in this and other SSCI courses, are graded on the letter grade scale where A is exemplary, B is very good, C is satisfactory, D is unsatisfactory, and F needs improvement. Final grades use the same letter grade scale with C being the minimum passing grade for credit at the graduate level. The grading scale follows:

A	> 93 points		B-	80-82 points		D+	67-69 points
A-	90-92 points		C+	77-79 points		D	63-66 points
B+	87-89 points		C	73-76 points		D-	60-62 points
B	83-86 points		C-	70-72 points		F	<60 points

Assignment Submission Policy

Unless otherwise noted, assignments must be submitted via D2L by the due dates specified in the Course Schedule below and on the assignment instructions.

Unless otherwise noted, all Assignments are *due by 11:59 pm Pacific Time (PT) on the indicated date*. Project components have different due dates as indicated on the Course Schedule below. Your attention to on-time assignment submission is essential if I am to meet my goal to return comments on your submitted assignments before the next one is due. Sometimes this is impossible, so I will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.

Schedule

Date	Class Topic/Activity	Readings and Assignments	Deliverables: Due Dates
Weeks 1 - 3: Module 1 | Spatial Analysis Foundations: Overlay and MCDA			
Week 1 5/16	Lecture: Introduction to the Course	Mierzwiak & Calka O&U, Chs. 1, 2, 11 (by 5/16) Reading & Research Discussion (RRD)1 Project 1	RRD1 Forum Posts: See Prompt Project 1 Workflow: Wednesday 5/29 11:59pm PT Project 1 Report: Wednesday, 6/5 11:59pm PT
Week 2 5/21	Overlay and Multiple Criteria Decision Analysis		
5/23	Introduction to Project 1		
Week 3 5/28	MCDA use cases and challenges		
5/30	Workshop: Project 1 Workflow Reviews and RRD1 briefing		
Weeks 4 - 6: Module 2 | Finding Patterns in Spatial Data			
Week 4 6/4	Point Pattern Analysis and Introduction to Project 2	O&U, Chs. 3 (68-71), 4 (93-119); 5 ,6 (6/4) Klaas et al. (by 6/4) O&U, Chs. 7, 8 (by 6/11) Jun and Namgung (by 6/11) Weir (by 6/11) RRD2 Project 2	RRD2 Forum Posts: See Prompt Project 2 Workflow: Wednesday, 6/12 11:59pm PT Project 2 Report: Wednesday, 6/19 11:59pm PT
6/6	RRD1 Discussion and Intro to RRD2; Point Pattern Analysis		
Week 5 6/11	Spatial Autocorrelation		
6/13	RRD2 discussion and presentation; Workshop: Project 2 Workflow Reviews		
Week 6 6/18	Exploring and testing spatial patterns		
6/20	Modelling geographical relationships		
Weeks 7 - 9: Module 3 | Distance-Based Analysis and Accessibility			

Date	Class Topic/Activity	Readings and Assignments	Deliverables: Due Dates
Week 7 6/25	Networks and Accessibility Analyses	Luo and Wang (by 6/25) Shi et al. (by 6/25) RRD3 Project 3	RRD3 Forum Posts: See Prompt Project 3 Workflow: Monday, 7/1 11:59pm PT Project 3 Report: Wednesday, 7/10 11:59pm PT
6/27	Intro to Project 3; Network Analysis Case Study; RRD 3 Intro		
Week 8 7/2 *7/4 is a university holiday	Workshop: Project 3 Workflow Reviews; RRD3 discussion and presentation		
Week 9 7/9	RRD 3 discussion and presentation		
7/11	Species Distribution Modeling with Maxent		
Weeks 10 - 12: Module 4 | Spatial Analysis with Computational Modeling			
Week 10 7/16	Agent-Based Modeling	O&U, Ch. 12 (341-354,360-368) (by 7/16) Kalinski (by 7/16) Philips et al. (by 7/23) Crooks, Ch. 1-3 (by 7/23) RRD4 Project 4	RRD4 Forum Posts: See Prompt Project 4 Workflow: Wednesday, 7/24 11:59pm PT Project 4 Report: Wednesday, 7/31 11:59pm PT
7/18	Intro to Project 4		
Week 11 7/23	RRD4 Discussion		
7/25	Workshop: Project 4 Workflow Reviews		
Weeks 13 - 15: Module 5 | Creation and Analysis of Fields			
Week 12 7/30	Interpolation and the Analysis of Grids and Surfaces	Resume Assignment O&U, Ch. 9, 10 (by 7/30) Wilson, Ch. 3.1.3, 3.1.4 (by 7/30) RRD5 Project 5	Resume Assignment: Wednesday, 7/31 11:59 pm PT RRD5 Forum Posts: See Prompt Project 5 Workflow: Wednesday, 8/7 11:59pm PT
8/1	Intro to Project 5 and case study		
Week 13 8/6	RRD5 Discussion		
8/8	Workshop: Project 5 Workflow Reviews		
	Finals Period		Project 5 Report: Final Exam Date/Time pm PT

Statement on Academic Conduct and Support Systems

Academic Integrity

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others (including AI generated) or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*

Non-emergency assistance or information.

[Office of the Ombuds](#) - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - *(323) 442-2850 or* otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Resources for Online Students

The Course D2L page and the SSI Student Hub on D2L have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/. Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. These include instructional videos, remote access to university resources, and other key contact information for distance students.